UCRL-ID-145892

NIF PEPC Mechanical Test Stand Safety Note

John W. Trent

May 21, 1998

U.S. Department of Energy

Lawrence
Livermore
National
Laboratory

DISCLAIMER

This work was performed under the auspices of the U. S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48.

NIF PEPC Mechanical Test Stand

Safety Note

MESN98-033-0A

J.W. Trent

May 21, 1998

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Distribution:

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G. Cruz	L-580
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Acknowledgement: J. Laughy and B. Funkhouser made major contributions in ideas and Pro/ENGINEER models including cg and mass calculations.

Contents

A Scope and Equipment Description

The NIF PEPC Mechanical Test Stand is to be used in the building 432. Building 432 is being used to test components and processes for NIF. The test stand is to be bolted to the floor. The test stand provides a platform from which the PEPC kinematic repeatability and vibrational characteristics of the PEPC LRU can be tested.

The test stand will allow user access to the LRU to install instrumentation and to make adjustments to the kinematics.

The mechanical test stand is designed to hold the 1700 lb. PEPC LRU.

B Operational Hazards

The primary operational hazard is structural failure of the test stand leading to either equipment damage or personnel injury. The design of the fixture and the limited usage of the fixture control this hazard. The fixture is designed with a minimal safety factor of 3 as required by the Design Safety Standards [1]. Access to the fixture will be limited to personnel in building 432 and the only load is the PEPC LRU, so loads are well defined.

C Procedures

The PEPC LRU will be connected to the test stand via its kinematics. As a safety precaution, lifting straps will be attached to the LRU that will hold it up in the event of failure of the test stand or kinematics. It will only be able to fall a couple inches in the event of stand failure before it is stopped by the lifting straps.

D Design Calculations

The assembly fixture was analyzed in accordance with the ME DSS for stands and all calculations are included in this note in Appendix A. A failure of this equipment is considered significant. The design load for the stand is a PEPC LRU, which weighs 1700 lbf.

The seismic (earthquake) loading should be the response spectrum concrete slab in building 432, which is unknown. Therefore, the LLNL ground level spectrum is used with the most conservative reasonable assumptions. In accordance with the DSS, the assembly fixture is considered a category 2 hazard or general-purpose equipment with a damping ratio of 5% and a peak amplification factor of 2.12. The fixture was analyzed using the method of seismic acceleration in three coordinate directions in accordance with section 5.2.6 of the ME DSS. This method adds 1g vertical, 1g in the worst horizontal orthogonal direction, and .4g in the other orthogonal horizontal directions. The result is in 2 g's vertical, 1 and .4 g in the horizontal plane.

The rare event (seismic) safety factor required is one. The lowest safety factor calculated for a seismic load is seven in the welds between the upper crossbar and main columns. This was calculated neglecting the upper bar stiffener plates and is very conservative.

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The static loading safety factors all exceeded 3 as per the ME DSS. The lowest safety factor for a static load is six in the main diagonals, assuming they support the entire bending moment load. Note that this was without taking into account the welds on the stiffener plates.

Factors of Safety				
BOM #	Part	Static FS (min 3)	Seismic FS (min 1)	Note
1	Lower Kinematic Plate	nc	nc	Almost no load
2	Big Lower Kinematic Plate	nc	nc	Almost no load
3	Upper Plate Welds	37	14	
4	Anchoring Plate Weld	nc	40	
5	Upper Bar Stiffener	nc	nc	Stiffener not necessary for strength
6	Main Diagonal	5	nc	Main Diag's not necessary for strength
7	Lower Frame Beam	nc	nc	Almost no load
8	Lower Frame Beam	nc	nc	Almost no load
9	Upper Crossbar	23	9	
	Welds between 9 and 10	16	7	
10	Main Column	206	88	Calc w/o main diagonal
11	Rear Column	634	nc	Almost no load
12	Lower Mounting Beam	nc	nc	Almost no load
13	Horizontal Stiffener	nc	nc	Almost no load
14	Diagonal Stiffener	huge	146	
	Legend: nc (not calculated)			

Kent Leung analyzed seismic tie down design, which are the anchor plate and bolts. He utilized ANSYS FEA and Hilti's anchoring software to find the loads, recommended sizes, and configuration. His calculations for expansion anchors were verified by John Trent for compliance to ME Design safety standards. The tensile-shear interaction was found to be .35, which complies with the requirement of being less than one. The tie down system used is four plates with four expansion anchors each which are Hilti HAS Super 5/8". The anchors are spaced 10 inches with 5 inches of concrete engagement each. For further calculation detail, please refer to Appendix A.

E Testing

Pull test concrete anchors. Anchors at rear of stand that take the tensile load tested exceeding calculated load in seismic event of 2002 lb. Test completed June 5, 1998.

Load Test Stand to 150% of load or 2500 lbf. Test on June 10, 1998.

F Labeling

The stand will be labeled with the following:

- Rated load capacity: 1700 lbf.
- Safety Note Number: MESN98-033-0A

- Assembly Drawing Number: AAA97-112377-OA

G Special Procedures

None

H References

1. ME Design Safety Standards
2. AISC Steel Construction Manual
3. Shigley & Mitchell. Mechanical Engineering Design. 4th Edition

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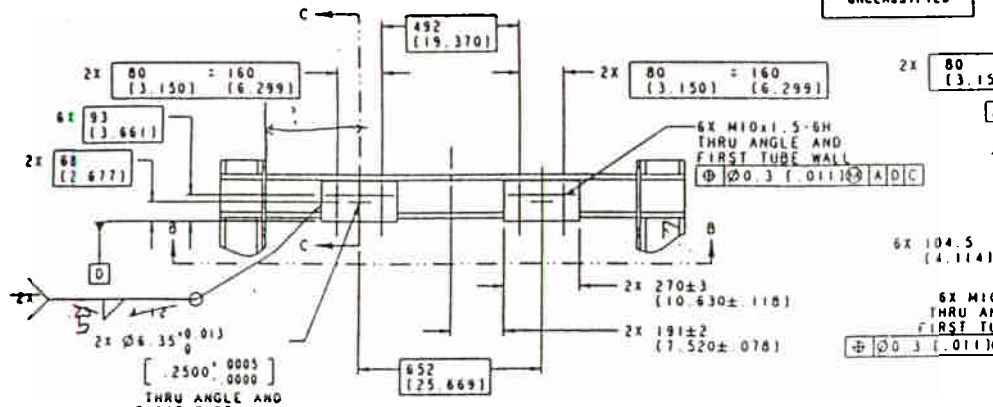

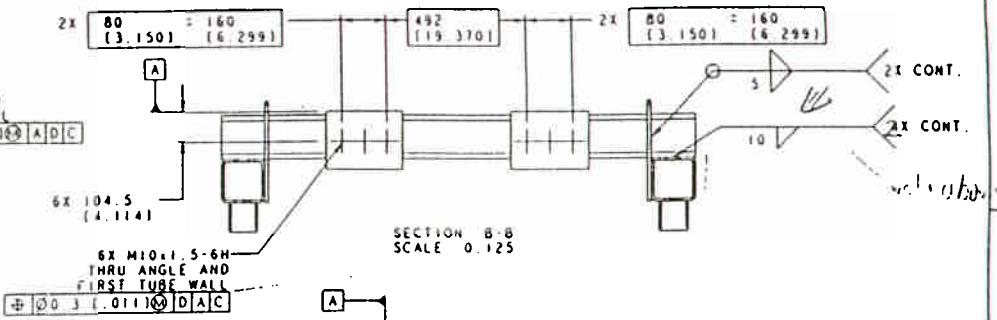

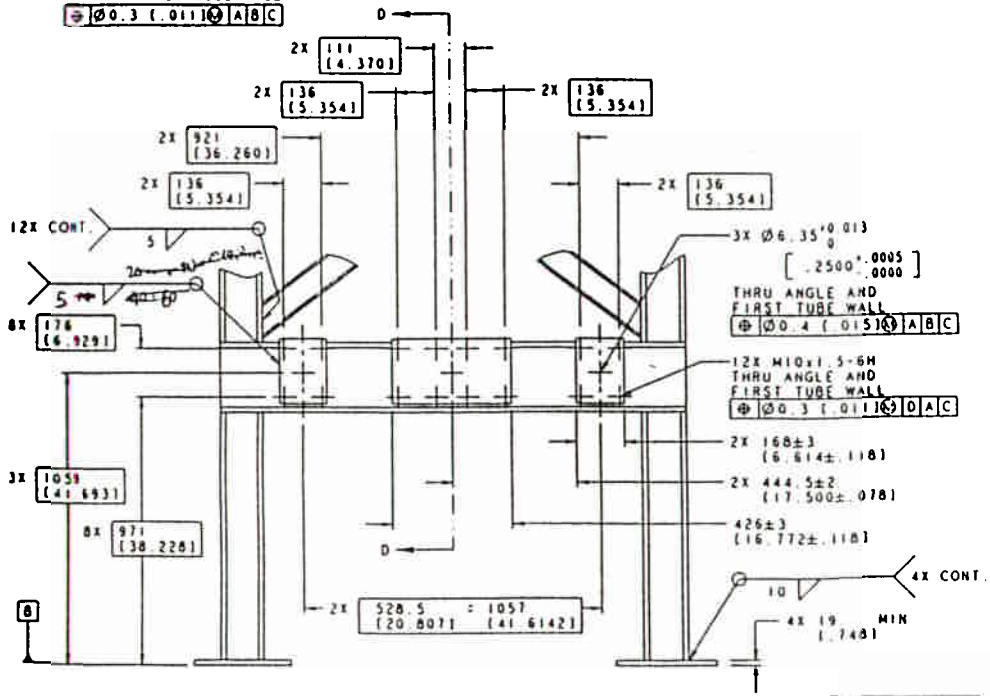

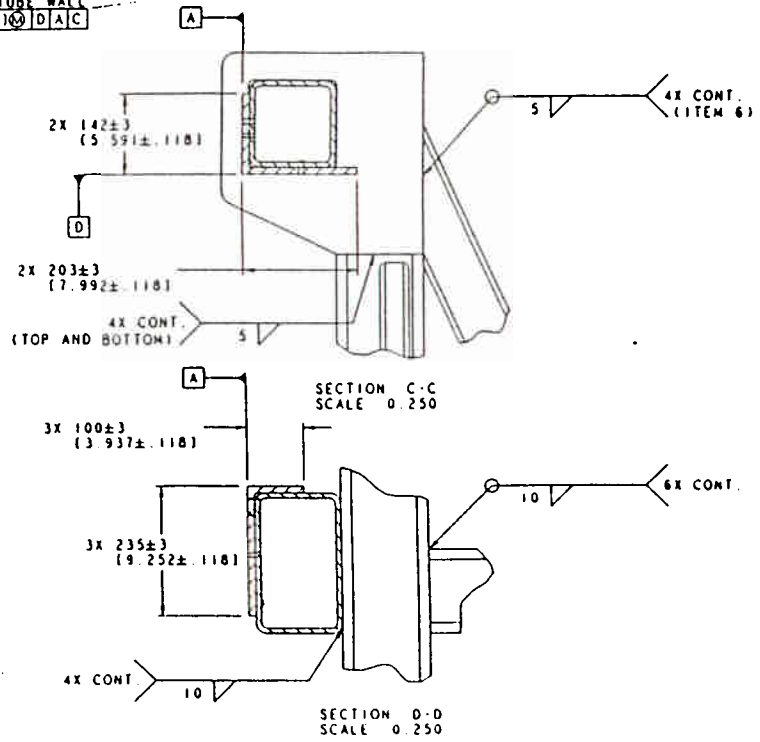

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SIZE	CAGE CODE	DWG NO
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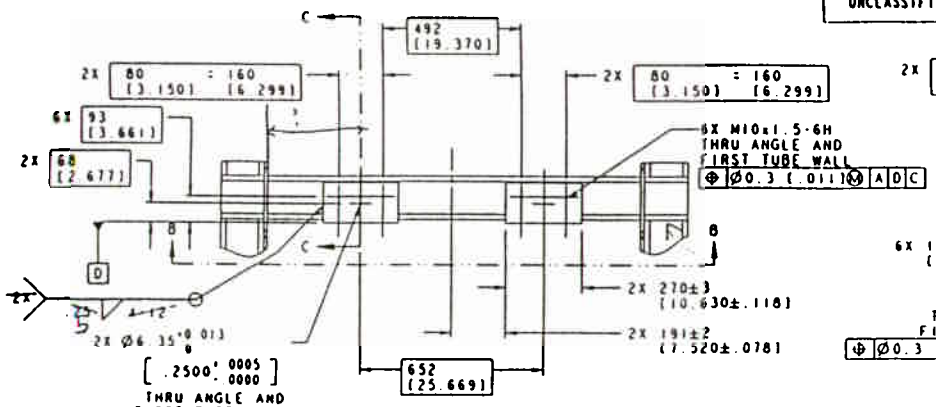

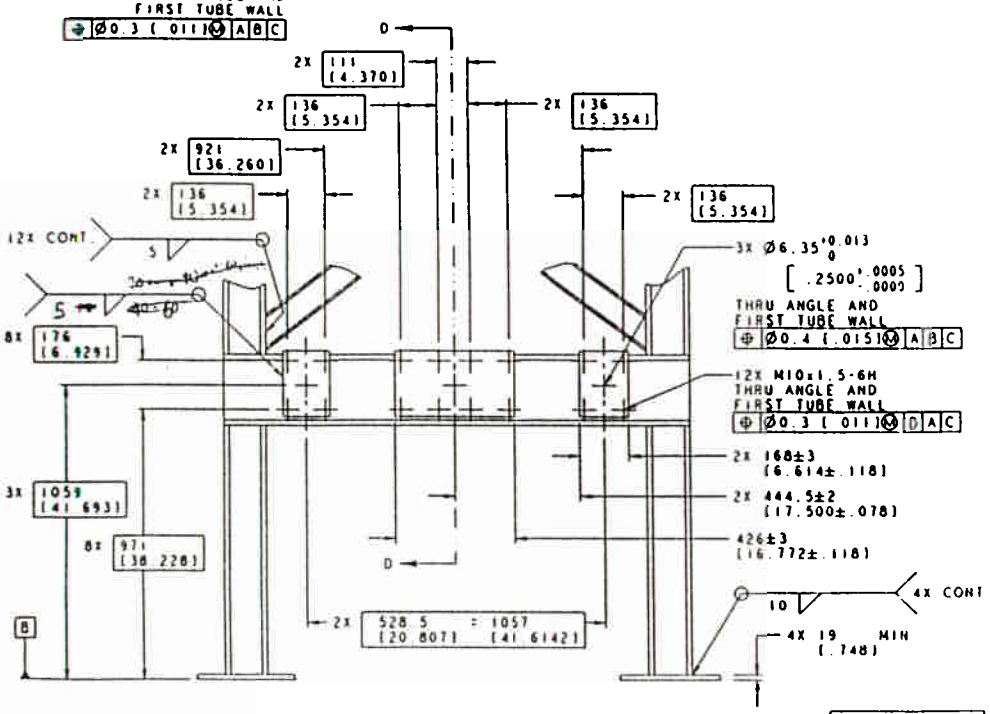

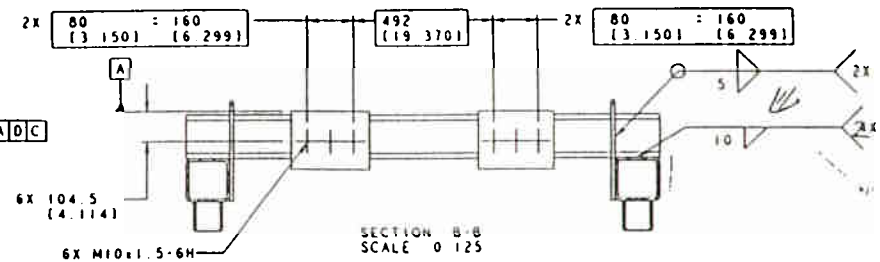

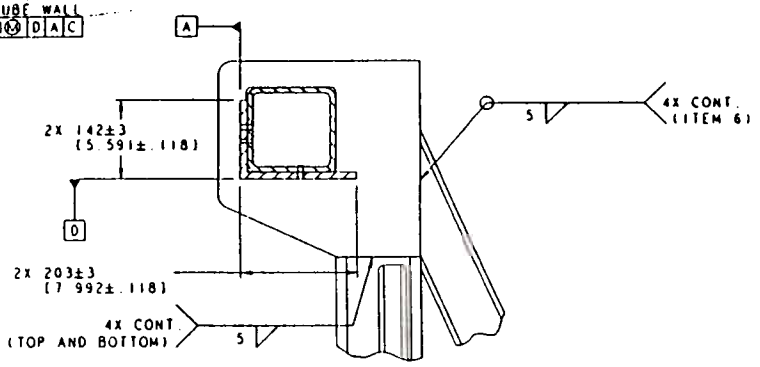

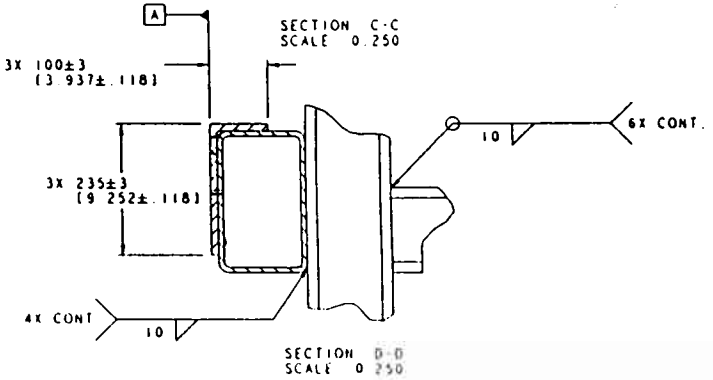

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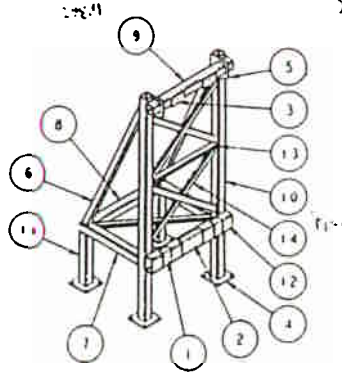
xT = 141.29 mm yT = -170.13

zT = 1550.00 mm

WT = 377516 g.



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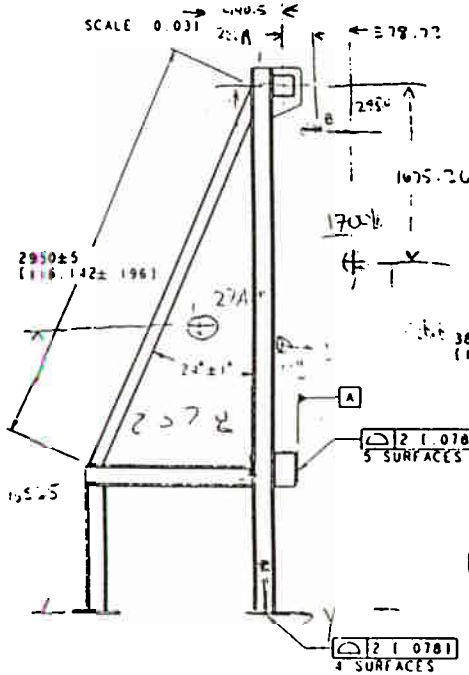

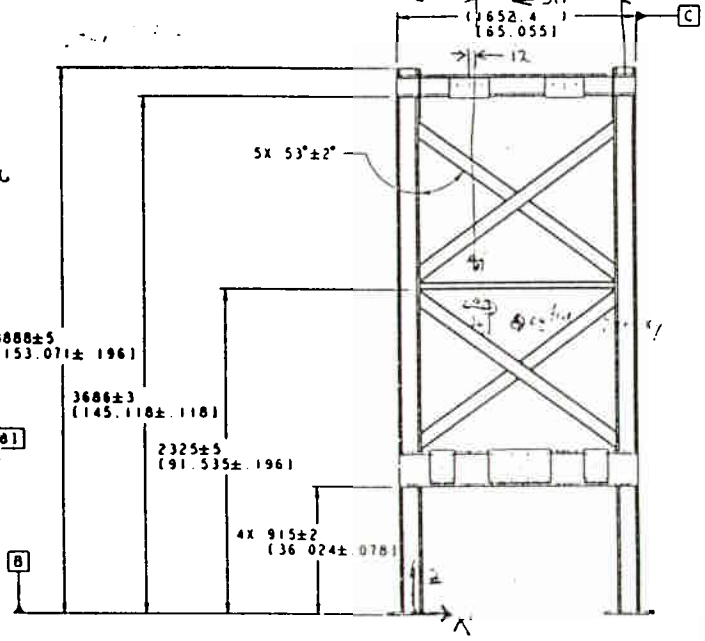

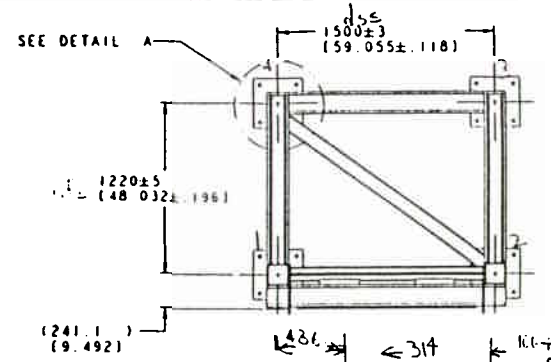

NOTES:

UNLESS OTHERWISE SPECIFIED:

101 ALL DIMENSIONS ARE IN MILLIMETERS AND VALUES ARE IN SI UNITS. DIMENSIONS AND VALUES IN BRACKETS ARE US CUSTOMARY UNITS CONVERTED FROM MILLIMETERS/SI UNITS.

102 APPLICABLE STANDARDS AND SPECIFICATIONS:
ASME Y14.5M-1994, DIMENSIONING AND TOLERANCING
ASME Y1.1-1989, ABBREVIATIONS
ASME Y14.36-1993, SURFACE TEXTURE SYMBOLS
NIF-0001270-08, NIF METRIFICATION POLICY

208 WELD IN ACCORDANCE WITH ANSI/AWS D1.1-92. WELD SYMBOLS PER ANSI/AWS A2.4-86. 0.25 MM [.010 IN] MAXIMUM DIAMETRICAL CLEARANCE BETWEEN MATING PARTS. STRESS RELIEVE PART AFTER WELDING AND PRIOR TO FINAL MACHINING.

103 3.2 [125] ALL MACHINED SURFACES PER ASME B46.1-1985, SURFACE TEXTURE.

104 REMOVE ALL BURRS AND BREAK SHARP EDGES 0.25MM [.010IN] TO 0.75MM [.030IN] CHAMFER OR RADIUS. RADII MUST MAKE A SMOOTH TRANSITION WITH MATING SURFACES.

201 METRIC SCREW THREADS PER ISO 724

107 INSPECTION/ACCEPTANCE TO BE IN SI UNITS.

801 ESTIMATED WEIGHT IS 942.9 KG [2078.7 LB].

REVISIONS

ZONE	REV	DESCRIPTION	DRN	CHK	APVD	DATE
	0A	INITIAL DRAWING RELEASE				

ITEM	QTY	PART NUMBER OR DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO
14	5	TUBE, SQ 152 X 102 X 3.18 WALL, 1764L	STL, ASTM A36	
13	1	TUBE, SQ 152 X 102 X 3.18 WALL, 1350L	STL, ASTM A36	
12	1	TUBE, 152 X 254 X 9.50 WALL, 1653L	STL, ASTM A36	
11	2	TUBE, 152 X 152 X 9.5 WALL, 896L	STL, ASTM A36	
10	2	TUBE, 152 X 152 X 9.5 WALL, 3869L	STL, ASTM A36	
9	1	TUBE, 152 X 152 X 9.5 WALL, 1653L	STL, ASTM A36	
8	1	TUBE, 152 X 152 X 9.5 WALL, 1347L	STL, ASTM A36	
7	2	TUBE, 152 X 152 X 9.5 WALL, 1220L	STL, ASTM A36	
6	2	TUBE, 102 X 102 X 3.18 WALL, 1764L	STL, ASTM A36	
5	2	PLATE, 355 X 355 X 12.7 THK	STL, ASTM A36	
4	4	PLATE, 350 X 350 X 19 THK	STL, ASTM A36	
3	2	ANGLE, 203 X 152 X 12.7 THK, 270L	STL, ASTM A36	
2	1	ANGLE, 203 X 102 X 12.7 THK, 424L	STL, ASTM A36	
1	2	ANGLE, 203 X 102 X 12.7 THK, 168L	STL, ASTM A36	

CLASSIFICATION: UNCLASSIFIED

METRIC

NIF WBS 133

LAWRENCE LIVERMORE NATIONAL LABORATORY

4X1 MECHANICAL INSTALLATION

DOCKING STAND ASSEMBLY

DOCKING STAND WELDMENT

SIZE D | CAGE CODE 14067 | DWG NO AAA97-112377 | REV 0A

AAA97-112377-0A-1

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